CALIFORNIA DEPARTMENT OF HEALTH SERVICES
850 Marina Bay Parkway, Richmond, CA 94804

ENVIRONMENTAL MANAGEMENT BRANCH
Marine Biotoxin Monitoring Program

Monthly Marine Biotoxin Report

October 2003

Technical Report No. 03-21

INTRODUCTION:

This report provides a summary of biotoxin activity for the month of October 2003. Ranges of toxin concentrations are provided for the paralytic shellfish poisoning (PSP) toxins and for domoic acid (DA). Estimates are also provided for the distribution and relative abundance of *Alexandrium*, the dinoflagellate that produces PSP toxins, and *Pseudo-nitzschia*, the diatom that produces domoic acid. Summary information is also provided for any quarantine or health advisory that was in effect during the reporting period.

Please note the following conventions for the phytoplankton and shellfish biotoxin distribution maps: (i) All estimates for phytoplankton relative abundance are qualitative, based on sampling effort and percent composition; (ii) All toxin data are for mussel samples, unless otherwise noted; (iii) All samples are assayed for PSP toxins; DA analyses are performed as needed (i.e., on the basis of detected blooms of the diatoms that produce DA); (iv) Please refer to the appropriate figure key for an explanation of the symbols used on the maps.

Southern California Summary:

Paralytic Shellfish Poisoning:

Increasing numbers of *Alexandrium* were observed at several sites along the San Luis Obispo coast during October (Figure 1). Small

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Figure 1. Distribution of toxin-producing phytoplankton in Southern California during October, 2003.

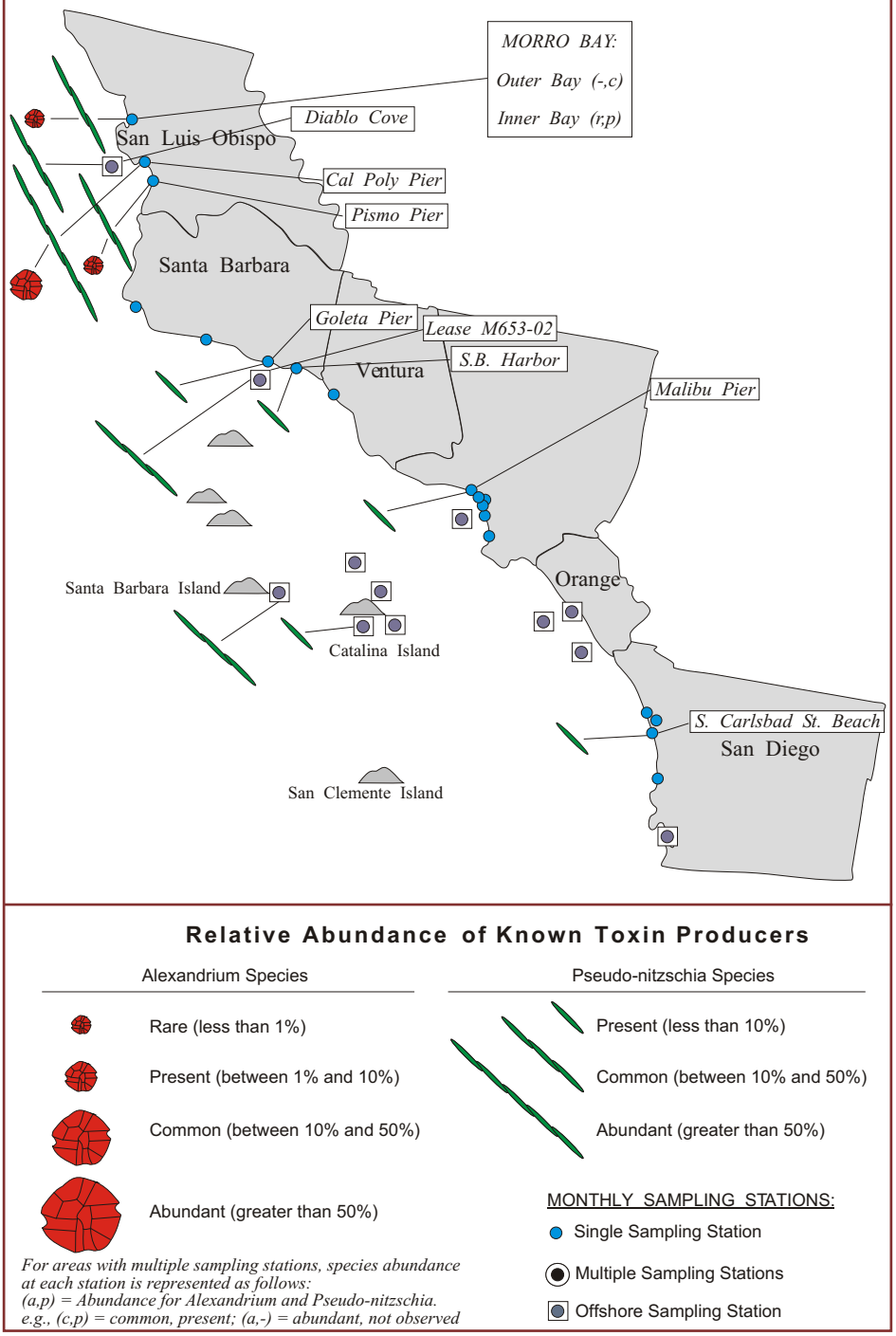
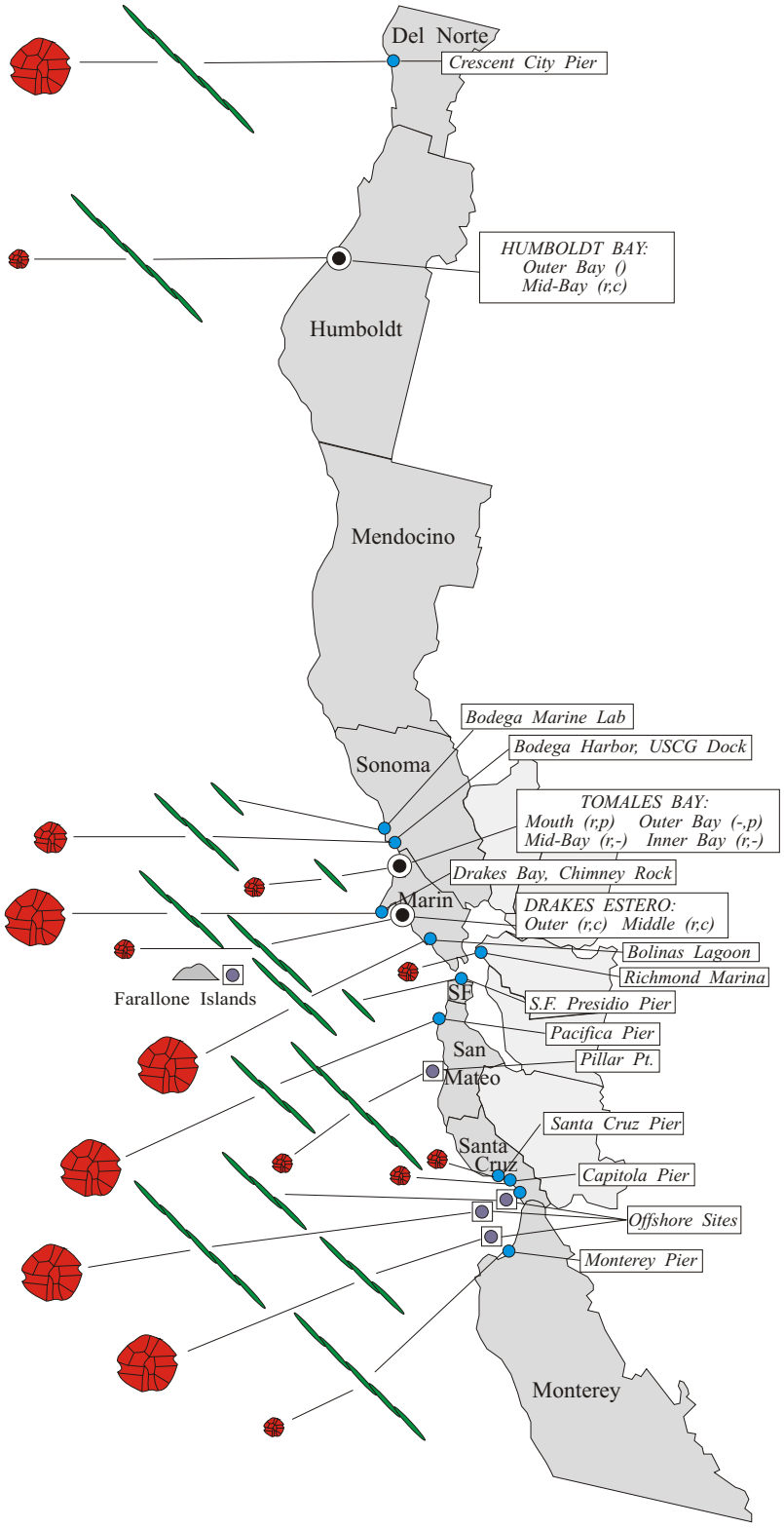


Figure 2. Distribution of toxin-producing phytoplankton in Northern California during October, 2003.



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numbers of this dinoflagellate species were observed inside Morro Bay, at the Cal Poly Pier in Avila, and at Pismo Pier. The relative abundance of *Alexandrium* increased through October 22 at the Avila site. Low concentrations of PSP toxins were detected throughout the month in mussel samples collected from Morro Bay. A low concentration of PSP toxins was also detected in a mussel sample collected from Avila on October 15.

Domoic Acid:

The distribution and relative abundance of *Pseudo-nitzschia* decreased in October at most locations along the Southern California coast compared to September's observations (Figure 1). However high relative abundances of this toxin-producing diatom continued to be observed along the San Luis Obispo coast at the Cal Poly Pier in Avila and at Pismo Pier.

Domoic acid was not detected in shellfish samples from Southern California locations during October (Figure 3).

Nontoxic Events - Red Tide Continues:

Extensive dinoflagellate blooms continued through October, creating massive "red tides" along the Southern California coast. *Lingolodinium polyedrum* was abundant

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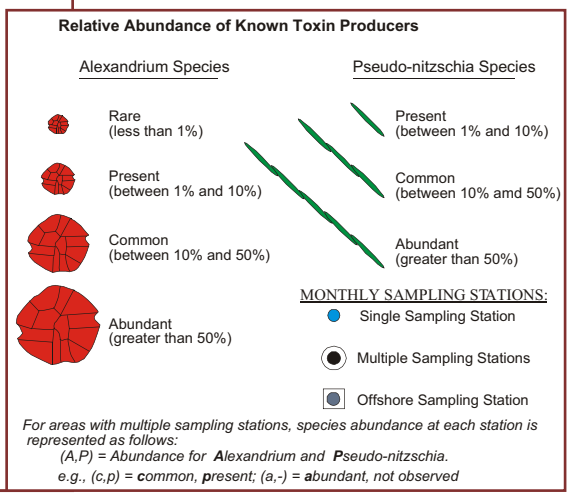
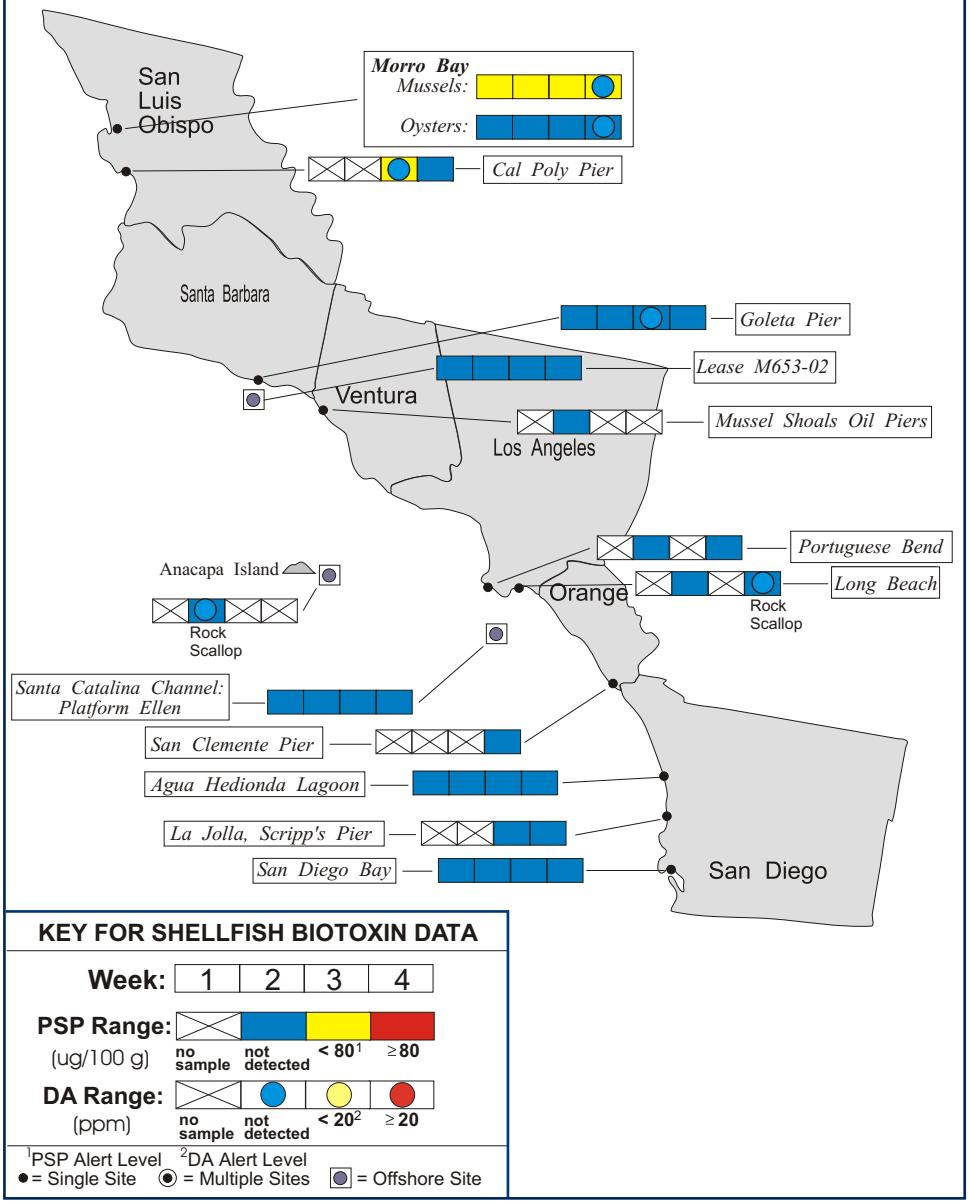


Figure 3. Distribution of shellfish biotoxins in Southern California during October, 2003.



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along the entire coastline from San Luis Obispo through San Diego. This dinoflagellate comprised between 90 to 99% of the species present in these areas. The greatest densities were observed at sites in Los Angeles and San Diego counties. Divers from the San Diego region reported the thickness of the bloom to extend at least 50 feet in depth at some locations (John Moore, personal communication). This spectacular event continued throughout the month, resulting in incredible displays of bioluminescence at night. See page 7 for a wonderful nighttime photo captured by diver and photographer Todd Warshaw, as well as for some additional information on bioluminescence and where to go to learn more about this phenomenon.

Northern California Summary:

Paralytic Shellfish Poisoning:

The relative abundance of *Alexandrium* increased throughout Northern California in October (Figure 2). The highest relative abundances were detected at locations in Del Norte, Marin, and San Mateo counties as well as at two offshore sites in Monterey Bay sampled by the Pacific Cetacean Group.

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The Marine Biotoxin Monitoring and Control Program, managed by the California Department of Health Services, is a state-wide effort involving a consortium of volunteer participants. The shellfish sampling and analysis element of this program is intended to provide an early warning of shellfish toxicity by routinely assessing coastal resources for the presence of paralytic shellfish poisoning (PSP) toxins and domoic acid.

The Phytoplankton Monitoring Program is a state-wide program designed to detect toxin producing species of phytoplankton in ocean water before they impact the public. The phytoplankton monitoring and observation effort can provide an advanced warning of a potential toxic bloom, allowing us to focus sampling efforts in the affected area before California's valuable shellfish resources or the public health is threatened.

For More Information Please Call:
(510) 412-4635

For Recorded Biotoxin Information Call:
(800) 553 - 4133

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Low concentrations of PSP toxins persisted in Humboldt Bay throughout October (Figure 4), continuing a pattern that first began in July. Farther south, along the Mendocino coast, the elevated level of PSP toxins detected in September (1600 ug) declined but remained above the alert level by the end of October (147 ug, October 27). Low levels of PSP toxicity were detected along the Sonoma coast at Salt Point State Park and inside Bodega Harbor. Southward in Marin there was a significant increase in PSP toxin concentration in mussels at the Drakes Bay sentinel station, ranging from nondetectable on October 21 to 153 ug on October 30. Toxin levels also increased above the federal alert level inside Drakes Estero by the last week of October, with concentrations reaching 209 ug and 334 ug in mussels in the outer and mid estero, respectively. Low levels of PSP toxins were also detected farther south in San Mateo and Santa Cruz by the end of October.

Domoic Acid:

Pseudo-nitzschia was present along the entire Northern California coastline during October (Figure 2). The relative abundance and distribution of this diatom increased at most locations throughout the month. The highest relative abundances of this diatom were observed inside Humboldt Bay (October 21) and at the Pacifica Pier (October 28). Although *Pseudo-nitzschia* was abundant at different locations inside Monterey Bay throughout October, the highest relative abundance was observed on October 1 in an offshore sample from Soquel Canyon.

Low levels of domoic acid were detected in mussels from the Mile Buoy in

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Figure 4. Distribution of shellfish biotoxins in Northern California during October, 2003.

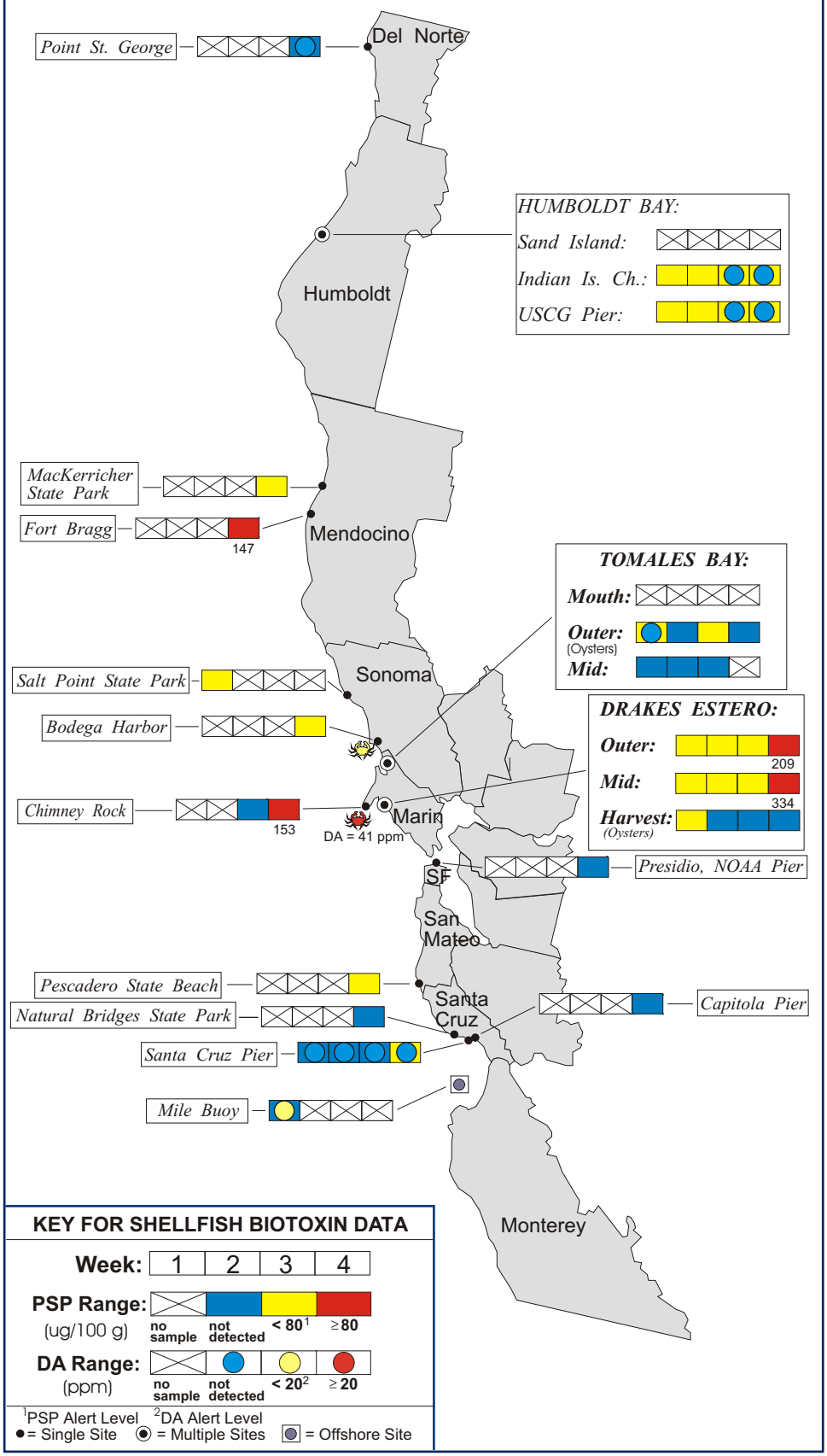

Table 1. California Marine Biotoxin Monitoring Program participants submitting shellfish samples during October, 2003.

COUNTY	AGENCY	# SAMPLES
Del Norte	Del Norte County Health Department	1
Humboldt	Coast Seafood Company	8
Mendocino	Mendocino County Environmental Health Department	1
	CDHS Marine Biotoxin Program Volunteer (Rouvaishyana)	1
Sonoma	Sonoma County Environmental Health Department	1
	CDHS Marine Biotoxin Program	1
Marin	Cove Mussel Company	3
	Hog Island Oyster Company	4
	Johnson Oyster Company	26
	Marin Oyster Company	2
	CDHS Marine Biotoxin Program	4
San Francisco	San Francisco County Health Department	1
San Mateo	San Mateo County Environmental Health Department	1
Santa Cruz	U.C. Santa Cruz	6
	Santa Cruz County Environmental Health Department	3
Monterey	None Submitted	
San Luis Obispo	Williams Shellfish Company	8
	U.C. Santa Barbara Marine Science Institute	3
	California Department of Fish and Game	1
Santa Barbara	U.C. Santa Barbara Marine Science Institute	5
	Santa Barbara Mariculture Company	6
Ventura	Ventura County Environmental Health Department	1
	CDHS Marine Biotoxin Program Volunteer (Bill Weinerth)	1
Los Angeles	Los Angeles County Health Department	2
	Aquarium of the Pacific Long Beach	4
Orange	Ecomar, Inc.	4
	Orange County Health Care Agency	1
San Diego	Carlsbad Aquafarms, Inc.	5
	Scripps Institute for Oceanography	2
	U.S. Navy	4

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Monterey Bay (3 ppm, October 2) and in rock crab viscera from Bodega Harbor (7 ppm, October 29). A high concentration of domoic acid was detected in rock crab viscera from Drakes Bay (41 ug, October 29). (Figure 4).

QUARANTINES:

The annual quarantine on the sport-harvesting of mussels, which went into effect on May 1st, was scheduled to be repealed at midnight on October 31st. However, the dangerous levels of PSP toxins detected at the end of October resulted in an extension of the annual quarantine until such time as toxin concentrations declined and remained at safe or undetectable levels. This annual quarantine applies only to sport-harvested mussels along the entire California coastline, including all bays and estuaries. This quarantine does not affect the commercial shellfish growing areas in California. All commercial shellfish growers certified by the State of California are required to submit routine samples for biotoxin analysis, allowing us to closely monitor for the occurrence of any toxin. Harvesting closures are imposed if toxin levels reach the federal alert level.

Consumers of Washington clams, also known as butter clams, are cautioned to eat only the white meat. Persons taking any clams or scallops are advised to remove and discard the dark parts (i.e., the digestive organs or viscera).

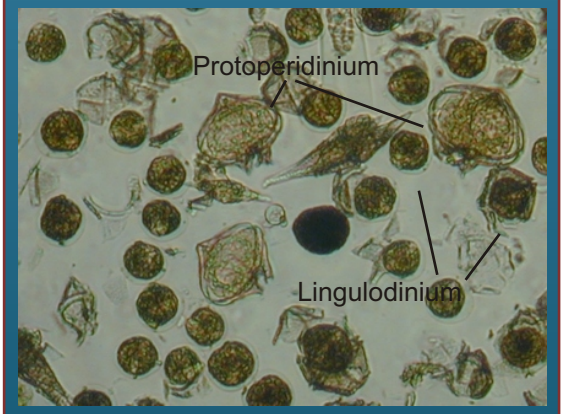
Contact the Department's "Shellfish Information Line" at 1-800-553-4133 or (510) 412-4643 for a current update on marine biotoxin activity.

Table 2. Agencies, organizations and volunteers participating in marine phytoplankton sample collection during October, 2003.

COUNTY	AGENCY	# SAMPLES
Del Norte	Del Norte County Health Department	4
Humboldt	Coast Seafood Company	4
Mendocino	None Submitted	
Sonoma	CDHS Marine Biotoxin Program	2
Marin	CDHS Volunteers (Brent Anderson, Richard Plant, Cal Strobel)	10
	Johnson Oyster Company	12
	CDHS Marine Biotoxin Program	4
Contra Costa	CDHS Marine Biotoxin Program	1
San Francisco	CDHS Volunteer (Eugenia McNaughton)	1
	CDHS Marine Biotoxin Program	1
San Mateo	San Mateo County Environmental Health Department	4
	CDHS Volunteer (Sandy Emerson)	2
Santa Cruz	Santa Cruz County Environmental Health Department	3
Monterey	CDHS Volunteer (Jerry Norton)	1
	Pacific Cetacean Group	4
San Luis Obispo	CDHS Volunteers (Rene and Auburn Atkins)	3
	Morro Bay National Estuary Program	3
	Tenera Environmental	1
Santa Barbara	U.C. Santa Barbara Marine Science Institute	4
	Santa Barbara City College	5
	Vandenberg AFB	1
	Santa Barbara Mariculture Company	5
	Catalina Tall Ships Expedition	1
Ventura	Ventura County Environmental Health Department	1
Los Angeles	Los Angeles County Sanitation District	4
	Catalina Tall Ships Expedition	10
	City of Los Angeles Environmental Monitoring Division	2
	Los Angeles County Health Department	1
	Los Angeles Regional Water Quality Control Board	1
	Aquarium of the Pacific Long Beach	4
Orange	Orange County Sanitation District	4
	Ocean Institute	1
	CDHS Volunteer (Robert Profeta)	1
San Diego	San Diego County Environmental Health Department	1
	CDHS Volunteer (Paul Sims, Randy Dick)	5
	Scripps Institute for Oceanography	2

PHYTOPLANKTON GALLERY

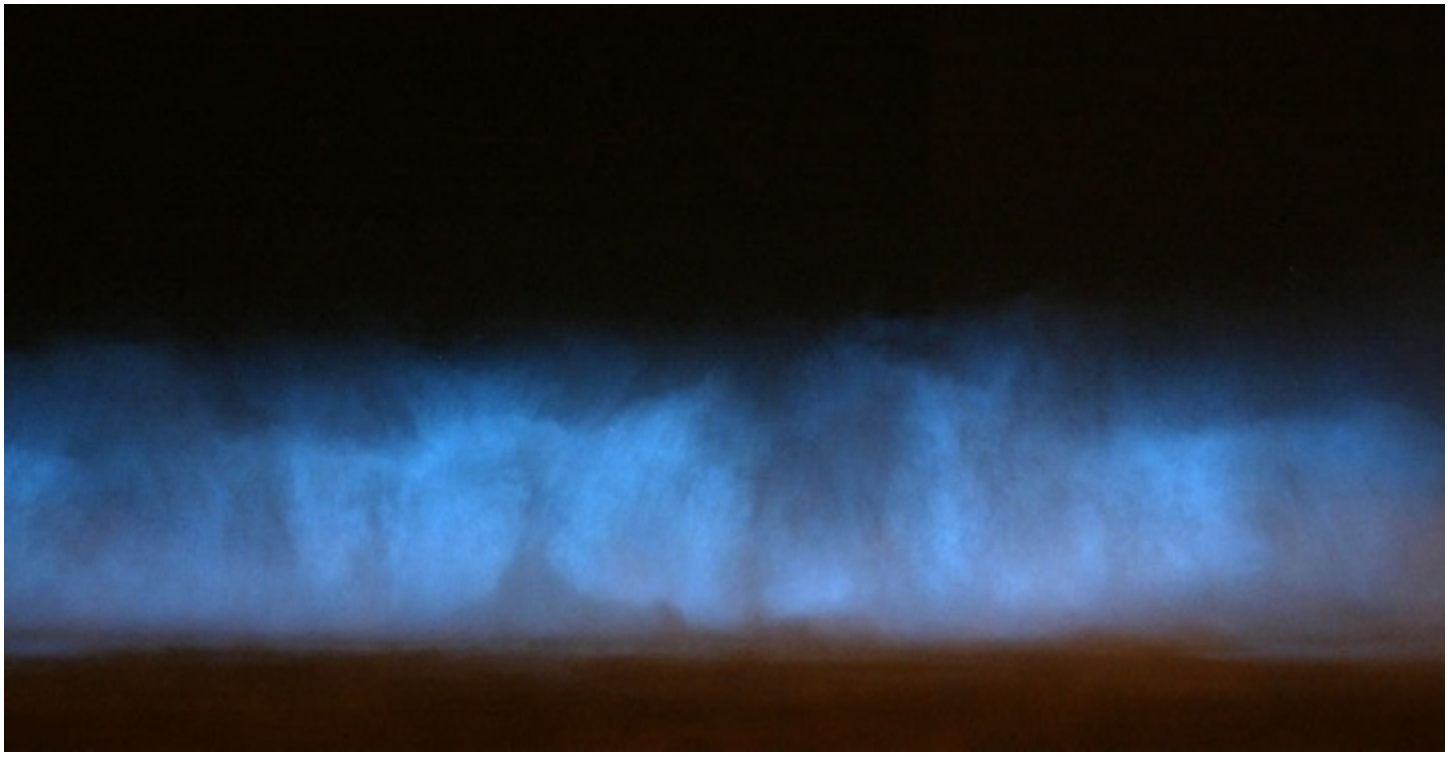
The PSP toxin producing dinoflagellate Alexandrium catenella increased along the Northern California coast during October.



The "red tide" dinoflagellate Lingulodinium was abundant along the Southern California coast. Cell walls can be seen on vegetative cells; the dark, dense, smoother bodies are resting cysts.

Despite the dominance of the red tide dinoflagellate along the Southern California coast, diatoms were still present offshore. The delicate Bacteriastrum was common in samples from Catalina Island in October.

Red Tide, Blue Waves



San Diego photographer and diver Todd Warshaw captured this image of bioluminescent waves crashing on La Jolla Shores beach in San Diego County. By day an expansive red tide that blanketed the coast from Santa Barbara through San Diego, at night a wonderful luminescent glow, this incredible event was made possible by the presence of millions of cells of the dinoflagellate *Lingulodinium polyedra* in each liter of seawater.

What is Bioluminescence?

If you are fortunate enough to observe a bioluminescent event like the one in the photo above, what you are really witnessing is a chemical reaction within each of the millions of dinoflagellate cells that make up the bloom. Within each cell a "chemiluminescent" process is occurring, with a substrate chemical (generically called "luciferin") being oxidized by a catalyst chemical (generically called "luciferase"), releasing a large amount of energy as light. The most common wavelength of light emitted by bioluminescent species is in the blue-green portion of the visible spectrum. Probably not so coincidentally, this is the wavelength that travels farthest through seawater.

Dinoflagellates like *Lingulodinium polyedrum* that are capable of this phenomenon don't constantly produce light. The process occurs during the dark phase of each day, and actually involves the movement of structures within the cell called "scintillons", which in turn contain the chemicals needed for luminescence. When in dark phase a dinoflagellate cell can be induced to emit light by mechanical processes (breaking waves on the beach, being bitten by a hungry copepod) as well as by chemical means (lowered pH, calcium).

Want to Learn More About Bioluminescence?

Check out the following web sites for more information on this complex process, for easy instructions on how to grow your own bioluminescent dinoflagellates at home, and for more incredible photographs of bioluminescence and the critters involved:

Http://www.lifesci.ucsb.edu/~biolum/

Http://explorations.ucsd.edu/biolum/

Http://www.biolum.org/

Http://www2.unibo.it/isbc/Files/BC_PlanktonNekton.htm

Http://siobiolum.ucsd.edu/

Http://www.nswseakayaker.asn.au/mag/46/bioluminescence.html

Http://www.biobay.com/

Http://www.divebums.org/